

(12) UK Patent Application (19) GB (11) 2 215 487 A (13)

(43) Date of A publication 20.09.1989

(21) Application No 8900586.2

(22) Date of filing 11.01.1989

(30) Priority data

(31) 3803078

(32) 03.02.1988

(33) DE

(71) Applicant

Robert Bosch GmbH

(Incorporated in the Federal Republic of Germany)

7000 Stuttgart 1, Postfach 50,
Federal Republic of Germany

(72) Inventors

Prof. Herman Kull

Joachim Berger

Ulrich Gerstung

(74) Agent and/or Address for Service

A A Thornton & Co

Northumberland House, 303-306 High Holborn,
London, WC1V 7LE, United Kingdom

(51) INT CL⁴

F02D 41/22

(52) UK CL (Edition J)

G3N NGK1 N288A N381

U1S S1990

(56) Documents cited

GB 2160337 A GB 2144180 A

(58) Field of search

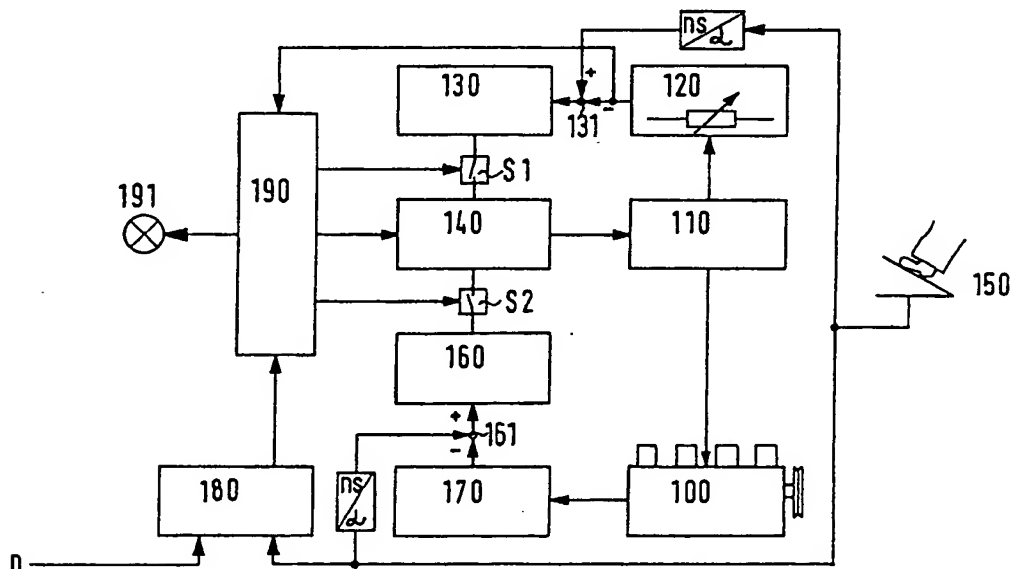
UK CL (Edition J) G3N NGK1 NGK2 NGK2A NGK2B

INT CL⁴ F02D

(54) Monitoring i.c. engine controls

(57) During overrun, a final control element (110) of the engine is briefly moved to a limit position and the output of an associated transducer (120) is assessed by a device (190) for plausibility. If a fault is detected a switch S1 is opened and a switch S2 is closed to change over to a emergency mode with speed control. A warning signal (191) may also be given.

FIG. 1



GB 2 215 487 A

FIG. 1

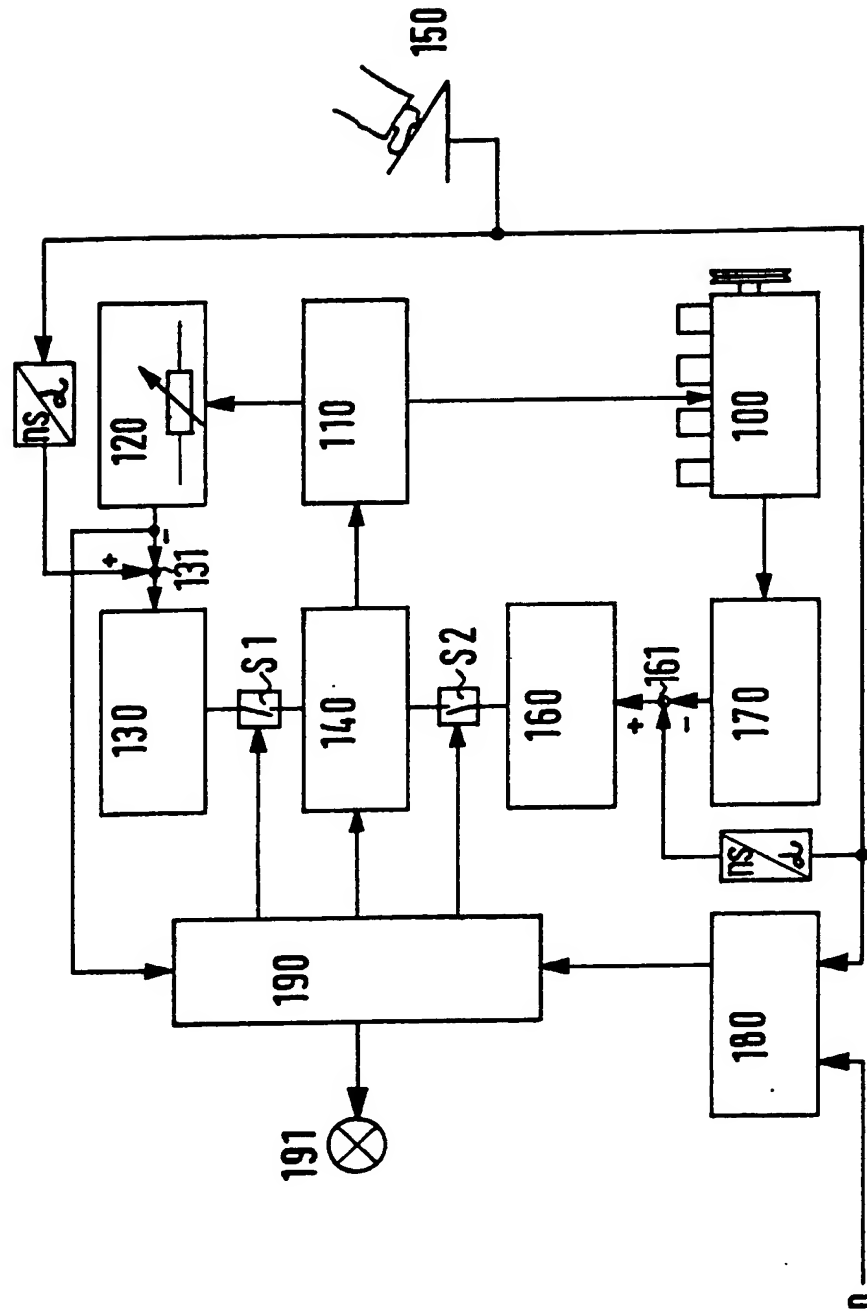


FIG. 2

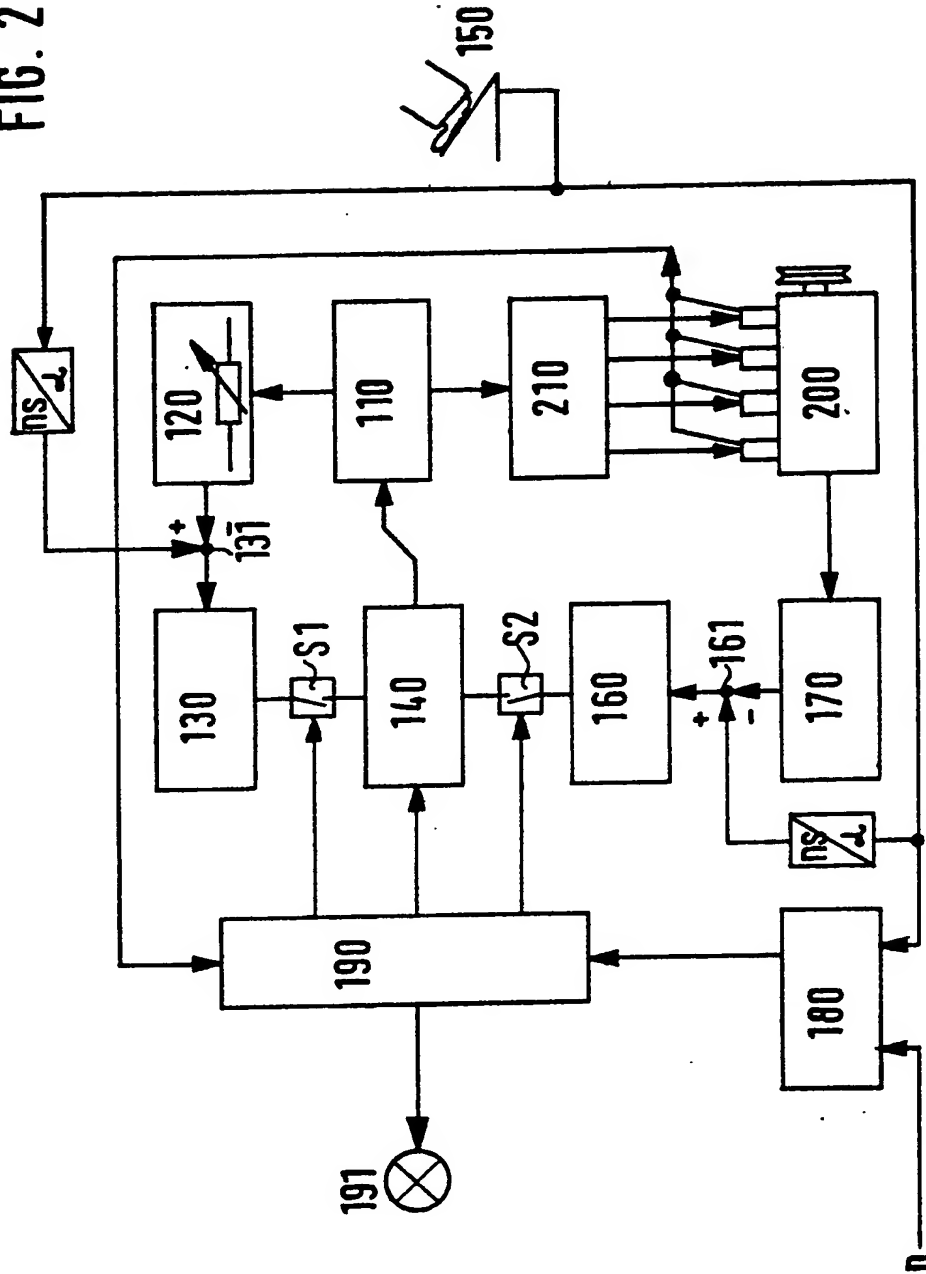


FIG. 3

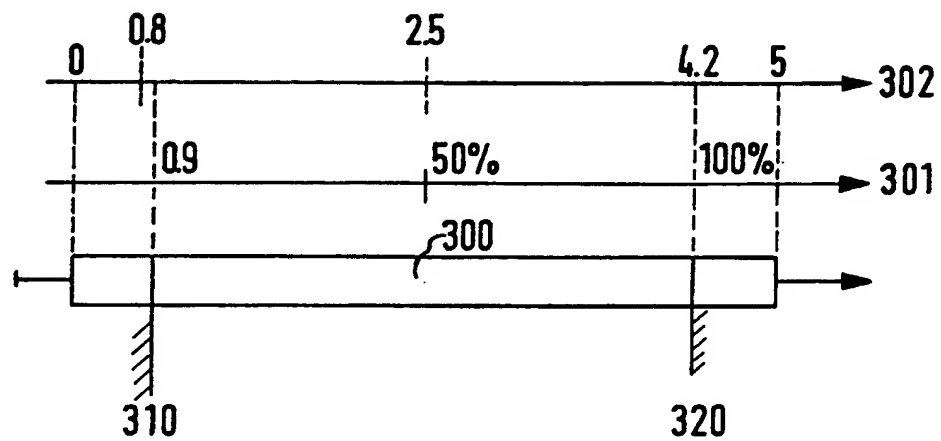
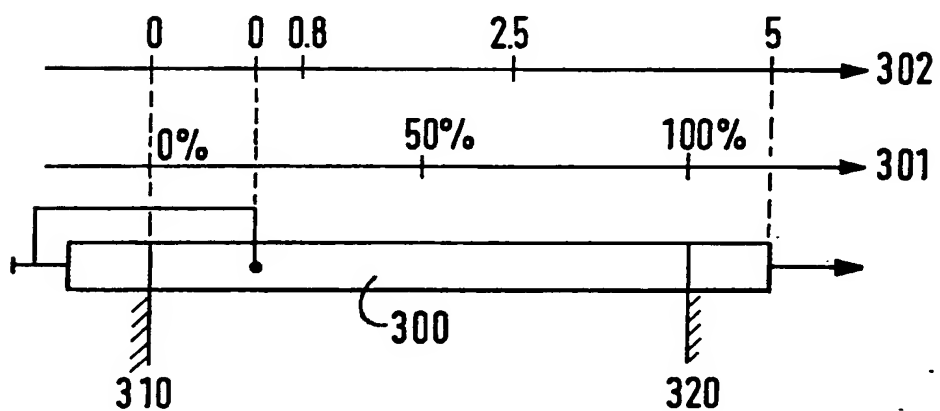


FIG. 4



Method of and apparatus for monitoring the position of an
electrical actual position transducer

Prior Art

5

The invention relates to a method of and an apparatus for monitoring the position of an electrical actual position transducer according to the pre-characterizing clause of Claim 1. Such a safety apparatus is known from DE-OS 3,301, 10 742. There the actual position signal is compared with an upper and lower limit value, so that a changeover to an emergency service mode occurs when the actual signal rises above or falls below one of the limit values. On the other hand, defects such as loosening of the mechanical connect- 15 ion between the final control element and the actual position transducer are not detected. A compensation of mechanical wear phenomena due to ageing is described in DE-OS 3,011,595. However, no detection of faults is provided in this case. An apparatus for detecting the farthest closed 20 position of the throttle valve of an internal-combustion engine is described in DE-OS 3,103,212. However, this adapted value is also not used for the detection of mechanical defects. An emergency control system for a diesel internal-combustion engine is described in DE-OS 3,130,094, 25 in which in case of a fault in the signal processing unit, the position signal of the accelerator pedal is connected more or less directly to the controller to modulate the switch box for the member which determines the quantity. This patent specification describes a possibility of adopt- 30 ing an emergency service mode in the case of defects in the modulation of the final control element. A method of adaptation of the upper and lower limit stop of an actual position transducer is also described in DE-OS 3,149,361. DE-OS 3,301,743 describes a safety device for an internal- 35 combustion engine with self-ignition, which is based upon the fact that a changeover to an emergency service mode occurs when an upper or lower limit value of actual signals is exceeded. DE-OS 1,962,570 also describes a safety system for interruptions in the control circuit and leads,

by which the final control element is returned automatically into its zero position in the case of a fault. Finally, DE-OS 3,343,481 describes a correction apparatus for a fuel dosing system of an internal-combustion engine, which effects a correction of the fuel dosing through the needle movement of the nozzle needle.

Advantages of the Invention

The position monitoring according to the invention having the features of the main Claim now makes it possible for the first time to detect all faults which can possibly occur, and simultaneously to perform a function test. By a corresponding modification of the idea of the invention, the invention can be applied both to self-ignition and also to applied-ignition internal-combustion engines. Because errors of very varied natures in the modulation of the final control element can be detected reliably by the invention, the availability of the motor vehicle is further improved in conjunction with such an emergency service apparatus.

Drawing

The invention is explained below with reference to the embodiment illustrated in the drawing. Fig. 1 shows as a block circuit diagram the embodiment of the invention for an applied-ignition internal-combustion engine, Fig. 2 shows the embodiment of the invention for a self-ignition internal-combustion engine. Fig. 3 shows the potentiometer track with the correct association of control stroke to control voltage, Fig. 4 shows the same potentiometer track with a leakage indicated diagrammatically, and with the resulting voltage values.

Description of the exemplary embodiment

An applied-ignition internal-combustion engine is designated 100 in Fig. 1. The actual final control element follow-up control circuit comprises the four blocks 110 to

140, a final control element for the internal-combustion engine being designated 110, an actual value transducer 120, the controller 130 and a final control element drive means 140. The command variable is fed by an accelerator pedal 150, possibly corrected by other quantities (speed for example) to the summation point 131, to which the actual value signal is also fed subtractively from the actual value transducer 120. The result of the differentiation is fed to the control system in the controller 130. The output signal of the controller 130 is fed through the switch S1 to the final control element drive means 140. The final control element drive means 140 then influences the final control element 110. A speed regulation means is present as a further control circuit. A speed signal is obtained for this purpose from the internal-combustion engine 100 in a speed actual value transducer 170. This speed actual signal is fed subtractively to a summation point 161. The sum result of the point 161 is fed to the speed control means 160, and from there further via a switch S2 to the final control element drive means 140. The command variable from the accelerator pedal 150 is also fed in the summation point 161. The circuit is completed by a monitoring device 190 having a fault acknowledgement device 191 and an overrun detection means 180, to which the command variable and the speed actual signal are fed. The output signal of the overrun detection means 180 and the actual signal of the final control element transducer 120 are fed to the monitoring device 190. The fault acknowledgement means 191, the two switches S1, S2 and the final control element drive means 140 are modulated by the monitoring device 190.

In the normal service mode the switch S1 is closed, whereas the switch S2 is open. When the service mode changes into an overrun mode, which is detected by the overrun detection device 180, after a certain time T1 the switch S1 is opened, and instead the final control element drive means is moved towards the minimum stop limiting means so briefly (a few milliseconds) that further special service programs, particularly a bucking damping or a towing torque

limitation, are permitted at least so that the driver is unaware of the running of the test function. The signal of the final control element actual position transducer 120 is then observed. During these tests, which may be
5 activated a plurality of times in relatively long periods (seconds range), if this signal assumes an implausible value one or more times, then a fault is detected and a changeover to emergency service mode occurs. The emergency service mode is ensured by the switch S2 being closed,
10 whereas the switch S1 is opened, and the journey can be continued with the superimposed speed control circuit. A signal acknowledgement may also be made to the driver.

Fig. 3 shows the correct association of control stroke/voltage, a potentiometer track being designated
15 300, the control stroke transducer stroke 301, and the associated voltage scale 302. The lower and upper mechanical stop are designated 310 and 320 respectively.

Fig. 4 shows a fault due to leakage. The designation of the various scales is taken from the description
20 of Fig. 3. This shows clearly that when the lower stop is reached the voltage becomes exactly zero, which is detected as a fault and treated correspondingly. Another advantageous further development of the invention may be made so that the potentiometer track is fed from an
25 electronic constant-current source. Leakages within the potentiometer track could also be detected reliably in this case.

Fig. 2 shows the invention in an embodiment for a self-ignition internal-combustion engine. The designation of the components is largely taken from Fig. 1.
30 Only the self-ignition internal-combustion engine 200 has been given a new designation. The injection pump 210 has also been added. Another change is that instead of the position actual signal from block 120, the output signal
35 of a needle movement sensor, or also a delivery start sensor signal in conjunction with at least one injection valve, is fed as a redundant overrun signal to the monitoring device 190. The use of a combustion start sensor in the cylinder of the engine is also conceivable in

- 5 -

principle. If none of these signals are available, then the functional cycle may take place exactly as described in Fig. 1.

Claims

1. Method of monitoring the function of an electrical actual position transducer (120) in the final control element (110) to determine the power of an internal-combustion engine, characterized in that extreme positions, particularly the mechanical limit stop, are reached briefly, and the position acknowledgement is tested for plausibility, in specific service situations, particularly in the over-run service mode.
2. Method according to Claim 1, characterized in that the output signal of the final control element actual position transducer is used as the position acknowledgement.
3. Method according to Claim 1, characterized in that the signal of a needle movement sensor and/or of a delivery start sensor and/or of a combustion start sensor is used as position acknowledgement in self-ignition internal-combustion engines.
4. Method according to one of Claims 1 to 3, characterized in that the test function can be activated a plurality of times in relatively long periods (seconds range) in the overrun service mode.
5. Method according to one of Claims 1 to 4, characterized in that the final control element desired value is reduced very strongly for only a few milliseconds each time for the test function, so that further special service programs in the overrun service mode, particularly a bucking damping or a towing torque limitation, are permitted at least so that the driver is unaware of the running of the test function.
6. Method according to one of Claims 1 to 5, characterized in that an emergency service function is initiated, particularly a controlled travel with superimposed speed control circuit or a definite overrun cut-out, when a fault is detected by the test function.
7. Method according to one of Claims 1 to 5, characterized in that an emergency service function is initiated, particularly a controlled travel with superimposed speed control circuit or a definite cut-out of the injection in

the overrun service mode, only when a fault is detected by the test function a plurality of consecutive times.

8. Method according to either of Claims 6 and 7, characterized in that a signal acknowledgement is passed to the driver upon detection of the fault.

9. Method according to either of Claims 6 and 7, characterized in that the potentiometer of the actual position transducer is supplied from a constant-current or constant-voltage source.

10. Apparatus for performing the method according to one of Claims 1 to 9, characterized in that means (180) are present which permit a detection of the overrun service mode and can act from the control circuit so that the final control element can be moved into an extreme position and the actual final control element signal which is then delivered can be tested for plausibility.

11. Apparatus according to Claim 10, characterized in that means are present for a speed control circuit with which an emergency service device can be realised.

12. Apparatus according to either of Claims 10 and 11, characterized in that a signal (191) can be passed to the driver in case a fault is detected.

13. Either of the embodiments of method of monitoring the function of an electrical position transducer substantially as herein described with reference to the accompanying drawings.

14. Either of the embodiments of apparatus for monitoring the function of an electrical position transducer substantially as herein described with reference to the accompanying drawings.

Docket # S3-02P16225

Applic. # PCT/EP2003/013378

Applicant: JEROME BOUCHAIN ET AL.

Lerner and Greenberg, P.A.
Post Office Box 2480
Hollywood, FL 33022-2480
Tel: (954) 925-1100 Fax: (954) 925-1101